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MANAGER

PRODUCT MARKETING

CAMERA & DISPLAY TUBES

INDUSTRIAL TUBE PRODUCTS
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA

NEW HOLLAND PIKE
LANCASTER, PA.
(717) 397-7661

Scan-Conversion Storage Tubes For

- Multi-Sensor Displays
- Air Traffic Control Systems
- Weapon Systems in Military Aircraft
- Target Designation Systems

RCA TYPES

C22001 *
C22006 *
C22007 *
C22008 *
7539

RCA Graphechons are rugged electrical-input, electrical-output storage tubes having axially mounted reading and writing guns. They are designed for use in data processing applications where signal information must be continuously transformed, with small loss in detail, from one scanning presentation, or time base, to another. The principle of bombardment-induced conductivity (BIC) is involved in the writing process, and the principle of capacitor charge in the reading process.

The graphechon is designed primarily for use in systems where radar information is to be presented on television-type monitors rather than on display-storage tubes or cathode-ray tubes having long persistence. The persistence of the displayed radar signals in such systems is determined by the characteristics of the graphechon and the brightness by the TV monitor. Three types of systems in which the graphechon finds use are:

Systems in which it is desirable to present signal information from other sources such as infrared sensors, TV cameras, graphical overlays, or alpha-numeric characters, with radar information in an integrated display, either simultaneously, or sequentially in selected display modes.

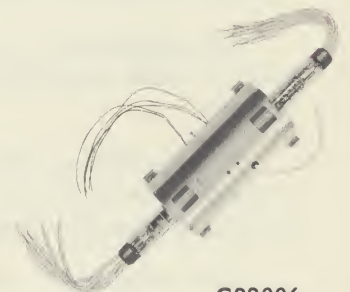
Systems in which it is desirable to repeat the display of radar information at several locations, some of which may be located at a considerable distance from the radar receiver.

Systems in which a single radar receiver and a single radar display are employed; and it is desirable because of display size, brightness, available space, or other considerations to use a short persistence TV monitor in combination with the graphechon rather than a display-storage tube, or cathode-ray tube having long persistence.

The graphechon has three sections, a writing, a reading, and a target section. Both the writing and the reading sections contain electron guns which provide high-velocity beams. The target section, which is positioned between the writing and reading sections, contains the target assembly. This assembly consists of a layer of dielectric material bonded to a layer of conducting material and supported by a fine metallic mesh. Because only a single mesh is used in the graphechon, the device is inherently rugged, and moiré effects, which are associated with multiple-mesh target sections, are minimized. The magnitude of the writing-gun signal which appears at the signal output electrode is negligible compared to the useful



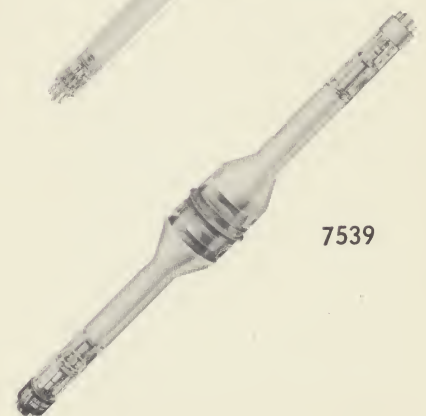
C22001
C22008



C22006



C22007



7539

*Each of these numbers identifies a developmental type suitable for engineering evaluation. The number and identifying data are subject to change. Before specifying any of these types in production equipment, please contact RCA. No obligation is assumed by RCA as to future manufacture of developmental types unless otherwise arranged.

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Electronic Components and Devices
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STC-901 1-66
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signal information. Accordingly, excellent read-write separation is obtained without the use of RF or other signal separation circuitry.

The output signal from the graphechon consists of a current in the range of 0.1 to 1 microampere. Noise directly contributed to the output signal by the graphechon is negligible compared to that introduced by the output-signal amplifier and its coupling arrangement. The noise introduced by the output-signal amplifier is in part determined by the capacitance of the output-signal electrode of the graphechon. The graphechon is designed to have a very low value of output-signal-electrode capacitance which enhances the production of displays having excellent signal-to-noise ratio.

Each scan of the target by the reading beam removes a portion of the written charge pattern. Information will be retained in the display until the written charge pattern is fully removed. The period of time during which information is retained in the display may be varied by suitable adjustment of the operating voltages. For useful values of output-signal current this period may be chosen within the approximate range of 1/2 to 20 seconds.

The capacitor charge reading process and the BIC writing process permits the use of non-collimated, high-velocity reading and writing beams. Consequently, it has been possible to make the deflection angles of the two guns equal with the result that geometric pattern-distortion is inherently low. The use of non-collimated, high-velocity beams and a single mesh structure make the graphechon no more difficult to "set up" than the conventional cathode-ray tube.

The graphechon is designed to provide rapid erase capability to facilitate its use in multi-mode displays in which a single graphechon is to provide more than one display and fast switching from one display to another is required.

The resolution of the graphechon should be matched to that of the overall system. The resolution capability of many of the smaller-size graphechons is consistent with the requirements of broadcast-quality television. Larger-size graphechons having higher resolution are available to meet specialized requirements.

RCA graphechons may be "customized" for size, resolution, and other characteristics to provide optimum performance for a specific system. Existing graphechon types can also be modified to have additional features such as integral magnetic-electrostatic shields and "fitted" electrode leads and cables. The graphechons described in this brochure are representative of RCA's capability. Many have been "ruggedized", i.e., are designed for use in the severe environments of shipborne and airborne equipment. Equipment manufacturers are encouraged to contact RCA regarding these devices and for assistance in selecting the proper graphechon for optimum performance of a given system. For additional information on these devices write **Manager, Storage-Tube Marketing, RCA, Lancaster, Pa.** or contact the Sales Offices listed in this brochure.

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GRAPHECHON

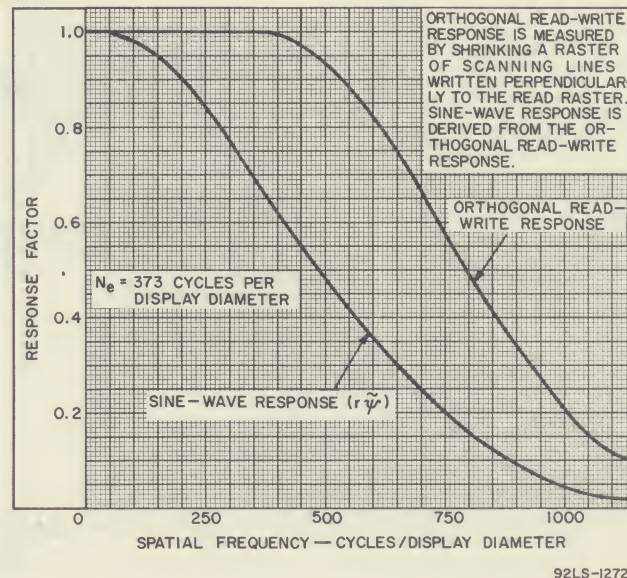
Scan-Conversion Storage Tube

RCA
DEVELOPMENTAL TYPE
C22001

RCA Developmental Type C22001 is a short, sturdy graphechon having resolution capability more than adequate for the requirements of most present day scan-conversion systems. It is designed for use in critical applications requiring extremely high resolution, minimum tube size, and low power. It employs low power "dark heaters" requiring only 0.6 watt. Both the reading and writing guns of the C22001 are magnetic-deflection, electrostatic-focus types. The approximate deflection angle of each gun is 50° .

- Intended primarily for use in systems employing television monitors utilizing 750 to 2000 scanning lines
- Intended primarily for use in systems where adjustable storage (persistence) times of 0.5 to 20 seconds are required
- Pattern erasure may be effected in approximately 500 ms when changing from one type of display to another
- Output-Signal-Electrode capacitance of approximately 16 pF

TYPICAL FREQUENCY RESPONSE CURVES



Typical Operating Conditions:

Voltages are referred to ground unless otherwise specified

Writing-Gun Section:

Heater Voltage ^a (AC or DC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-8000 volts
Grid-No.1 (Control Grid) Voltage ^b	
for Beam Cutoff	-120 to -70 volts
Grid-No.2 Voltage ^b	300 volts
Grid-No.3 (Beam Focus) Voltage ^{b,c}	600 to 1400 volts
Grid-No.4 (Anode) Voltage ^d	ground
Socket	Cinch No.133-98-11-015, or equivalent

Reading-Gun Section:

Heater Voltage ^e (AC or DC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-1200 volts
Grid-No.1 (Control Grid) Voltage ^f	
for Beam Cutoff	-120 to -70 volts
Grid-No.2 Voltage ^f	300 volts
Grid-No.4 (Beam Focus) Voltage ^{c,f}	200 to 440 volts
Grids-No.3 & No.5 (Anode) Voltage ^g	-20 to 0 volts
External Conductive Coating	ground
Socket	Cinch No.133-98-11-015, or equivalent

Target Section:

Output-Signal-Electrode Voltage	0 volts
Shading Electrode Voltage ^g	0 to 20 volts
Backplate Voltage ^g	-15 to 0 volts

^aOne side to be externally connected to writing-gun cathode.

^bWith respect to writing-gun cathode.

^cAdjust for best focus.

^dConnected internally to external conductive coating.

^eOne side to be externally connected to reading-gun cathode.

^fWith respect to reading-gun cathode.

^gAdjust for optimum signal and storage performance.

For further information or application assistance on this device, contact your RCA Field Representative or write Storage-Tube Marketing, RCA, Lancaster, Pa.

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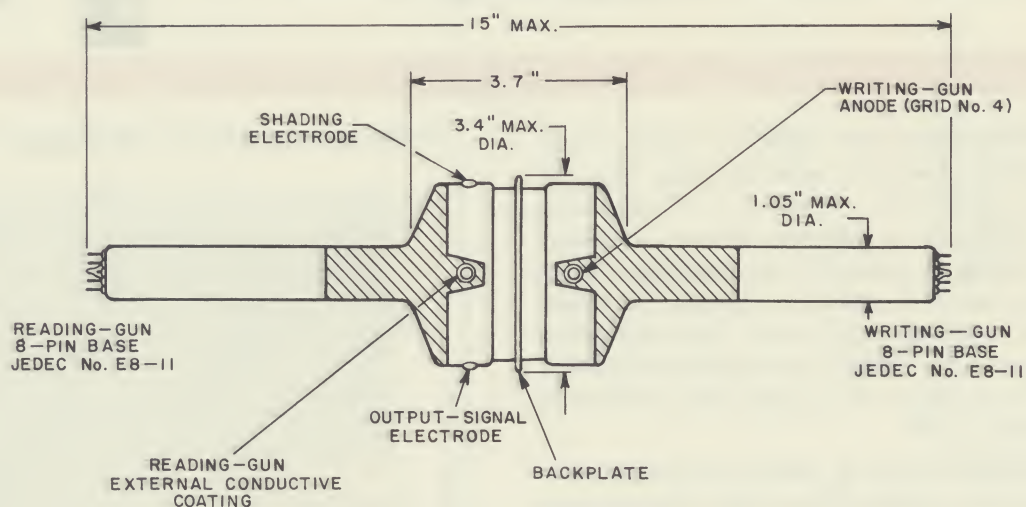


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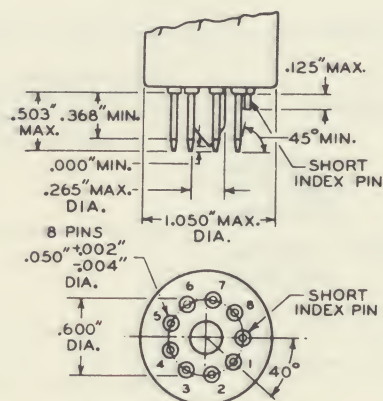
DIMENSIONAL OUTLINE



92LS-1284

BASE DRAWING

Both Guns



BASE CONNECTIONS

WRITING GUN -

- Pin No.1: Heater
- Pin No.2: Grid No.1
- Pin No.3: IC - Do not use
- Pin No.4: Grid No.3
- Pin No.5: Grid No.2
- Pin No.6: IC - Do not use
- Pin No.7: Cathode
- Pin No.8: Heater

READING GUN -

- Pin No.1: Heater
- Pin No.2: Grid No.1
- Pin No.3: Grid No.4
- Pin No.4: Grids No.3 & No.5
- Pin No.5: Grid No.2
- Pin No.6: IC - Do not use
- Pin No.7: Cathode
- Pin No.8: Heater

GRAPHECHON

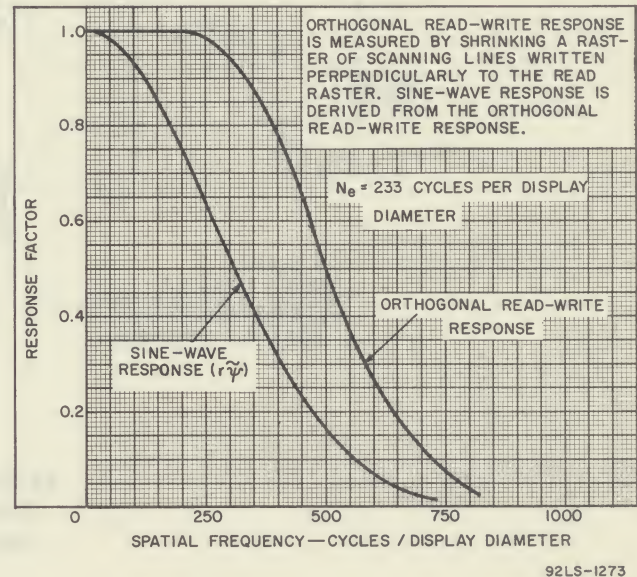
Scan-Conversion Storage Tube

RCA
DEVELOPMENTAL TYPE
C22006

RCA Developmental Type C22006 is a short, ruggedized graphechon having very high resolution capability. It is supplied with integral magnetic and electrostatic shields, encapsulated leads, and is designed to meet the environmental requirements of military aircraft. The C22006 employs low-power "dark heaters" requiring only 0.6 watt. The reading and writing guns of the C22006 are magnetic-deflection, electrostatic-focus types. The approximate deflection angle of each gun is 50°.

- Intended primarily for use in systems employing television monitors utilizing 500 to 1500 scanning lines
- Intended primarily for use in systems where adjustable storage (persistence) times of 0.5 to 20 seconds are required
- Pattern erasure may be effected in approximately 500 ms when changing from one type of display to another
- Output-Signal-Electrode capacitance of approximately 22 pF for 4" of coaxial cable

TYPICAL FREQUENCY RESPONSE CURVES



Typical Operating Conditions:

Voltages are referred to ground unless otherwise specified

Writing-Gun Section:

Heater Voltage ^a (AC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-8000 volts
Grid-No.1 (Control Grid) Voltage ^b	
for Beam Cutoff	-100 to -70 volts
Grid-No.2 Voltage ^b	300 volts
Grid-No.3 (Beam Focus)	
Voltage ^{b,c}	600 to 1400 volts
Grid-No.4 (Anode) Voltage	ground

Reading-Gun Section:

Heater Voltage ^a (AC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-1200 volts
Grid-No.1 (Control Grid) Voltage ^e	
for Beam Cutoff	-100 to -70 volts
Grid-No.2 Voltage ^e	300 volts
Grid-No.4 (Beam Focus)	
Voltage ^{c,e}	0 to 200 volts
Grids-No.3 & No.5 (Anode)	
Voltage ^f	-20 to 0 volts

Target Section:

Output-Signal-Electrode Voltage	0 volts
Shading Electrode Voltage ^f	0 to 20 volts
Backplate Voltage ^f	-15 to 0 volts
Shield ^g	ground

^aOne side to be externally connected to writing-gun cathode.

^bWith respect to writing-gun cathode.

^cAdjust for best focus.

^dOne side to be externally connected to reading-gun cathode.

^eWith respect to reading-gun cathode.

^fAdjust for optimum signal and storage performance.

^gThe shield should be grounded by both the target-section black lead and by the ground lug on the shield cylinder.

For further information or application assistance on this device, contact your RCA Field Representative or write Storage-Tube Marketing, RCA, Lancaster, Pa.

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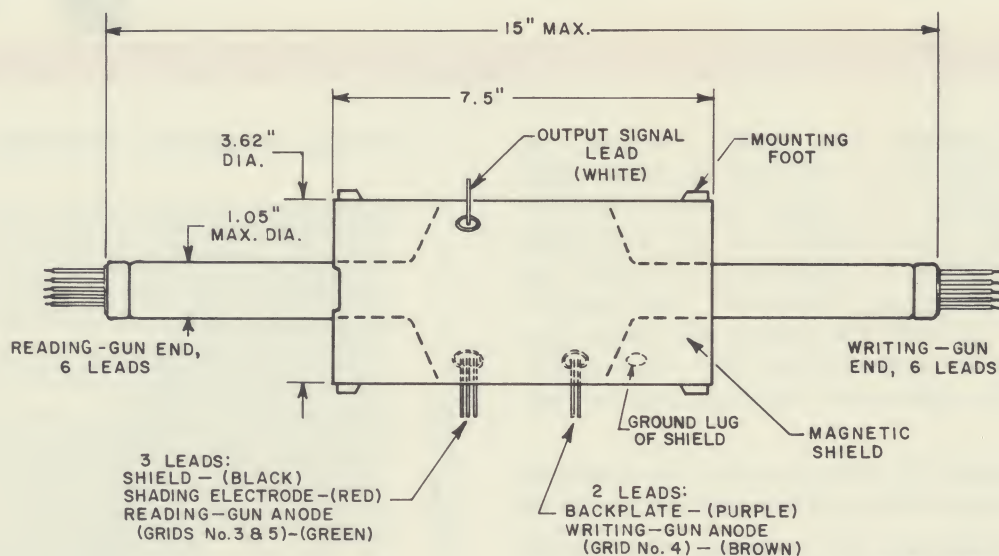
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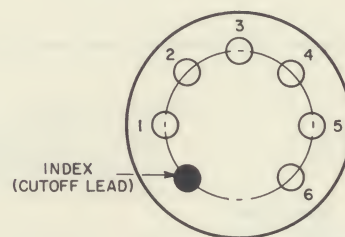
DIMENSIONAL OUTLINE



92LS-1286

BASE DRAWING

Bottom View
(Both Guns)



92LS-1288

BASE CONNECTIONS

WRITING GUN -

Lead No.1: Heater
Lead No.2: Grid No.1
Lead No.3: Grid No.3
Lead No.4: Grid No.2
Lead No.5: Cathode
Lead No.6: Heater

READING GUN -

Lead No.1: Heater
Lead No.2: Grid No.1
Lead No.3: Grid No.4
Lead No.4: Grid No.2
Lead No.5: Cathode
Lead No.6: Heater

Lead length is 6".

COLOR-CODED CENTER-SECTION CONNECTIONS

Output Signal Electrode (RG 195 A/U Coaxial Cable)	White
Shield	Black
Reading-Gun Anode (Grids No.3 & No.5)	Green
Shading Electrode	Red
Writing-Gun Anode (Grid No.4)	Brown
Backplate	Purple

Lead length is 12".

GRAPHECHON

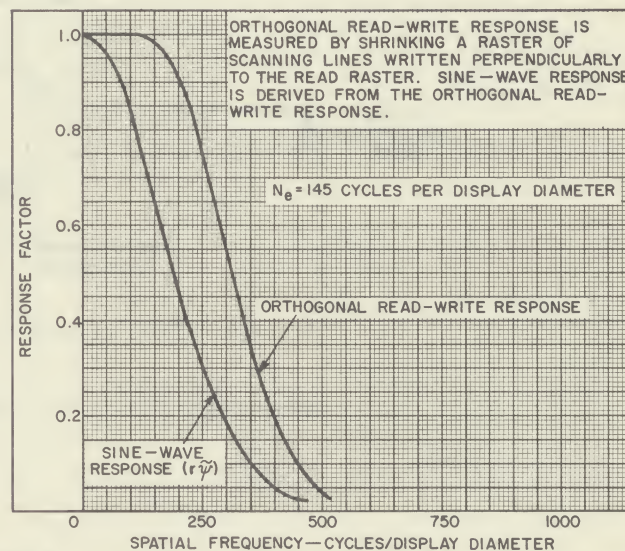
Scan-Conversion Storage Tube

RCA
DEVELOPMENTAL TYPE
C22007

RCA Developmental Type C22007 is a very short, sturdy graphechon designed primarily for ultra-compact scan-conversion systems in military aircraft. Its small size and low-power requirements make this tube highly suitable for systems where space conservation is of prime importance and miniaturized solid-state components are to be employed. It uses low-power "dark heaters" requiring only 0.6 watt. Its maximum neck diameter of only 0.58" permits the use of extremely small deflecting yokes having an outer diameter of 1.50" and a length of only 1.25" and a reading-gun focusing coil having an outer diameter of only 1.5" and 1" in length. Despite its small size, its performance capability is essentially equivalent to that of type 7539. The C22007 employs a magnetic-focus, magnetic-deflection type reading gun and an electrostatic-focus, magnetic-deflection type writing gun. The approximate deflection angle of each gun is 35°.

- Intended primarily for use in systems employing television monitors utilizing 500 to 1000 scanning lines
- Intended primarily for use in systems where adjustable storage (persistence) times of 0.5 to 20 seconds are required
- Pattern erasure may be effected in approximately 200 ms when changing from one type of display to another

TYPICAL FREQUENCY RESPONSE CURVES



92LS-1269

- Output-Signal-Electrode capacitance of approximately 8 pF

Typical Operating Conditions:

Voltages are referred to ground unless otherwise specified

Writing-Gun Section:

Heater Voltage ^a (AC)	6.3	volts
Heater Current at 6.3 volts	0.095	A
Cathode Voltage	-4500	volts
Grid-No.1 (Control Grid) Voltage ^b		
for Beam Cutoff	-110 max.	volts
Grid-No.2 Voltage ^b	600	volts
Grid-No.3 (Beam Focus) Voltage ^{b,c}	500 to 900	volts
Grid-No.4 (Anode)	See footnote (d)	
Socket	Alden No.207VIC, or equivalent	

Reading-Gun Section:

Heater Voltage ^e (AC)	6.3	volts
Heater Current at 6.3 volts	0.095	A
Cathode Voltage	-600	volts
Grid-No.1 (Control Grid) Voltage ^f		
for Beam Cutoff	-110 max.	volts
Grid-No.2 Voltage	ground	
Grid-No.3 (Anode) Voltage ^g	-20 to +20	volts
Socket	Alden No.207VIC, or equivalent	

Target Section:

Output-Signal-Electrode Voltage ^g	0 to 15	volts
Shading Electrode Voltage ^g	0 to 50	volts
Backplate Voltage	ground	

^aOne side to be externally connected to writing-gun cathode.

^bWith respect to writing-gun cathode.

^cAdjust for best focus.

^dConnected internally to backplate.

^eOne side to be externally connected to reading-gun cathode.

^fWith respect to reading-gun cathode.

^gAdjust for optimum signal and storage performance.

For further information or application assistance on this device, contact your RCA Field Representative or write Storage-Tube Marketing, RCA, Lancaster, Pa.

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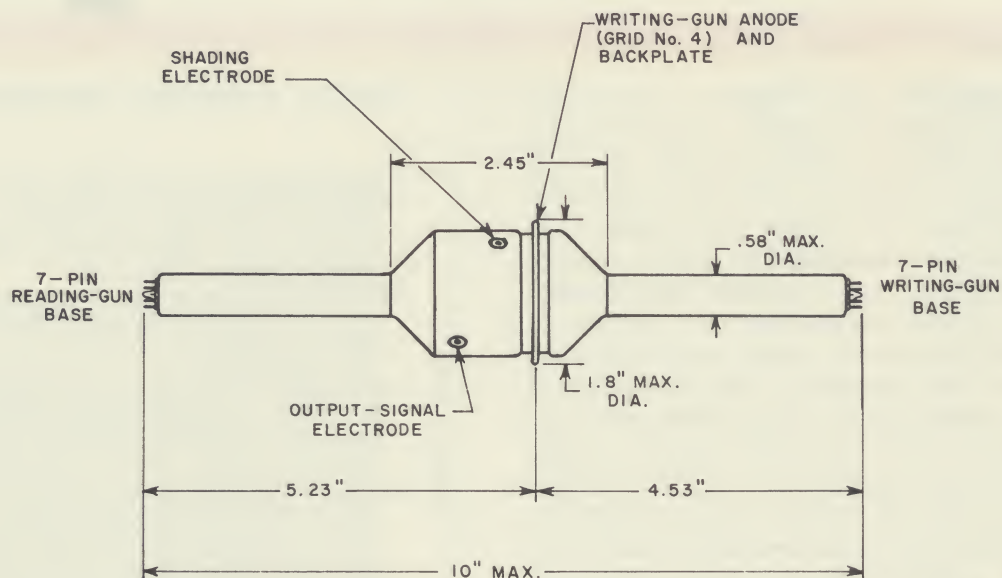


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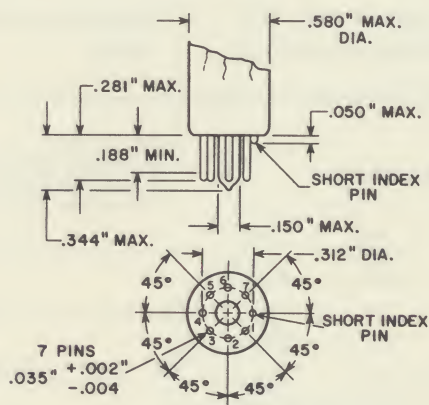
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DIMENSIONAL OUTLINE



92LS-1283

BASE DRAWING Both Guns



BASE CONNECTIONS

WRITING GUN -

Pin No.1: Heater
Pin No.2: Grid No.3
Pin No.3: Cathode
Pin No.4: Heater
Pin No.5: Grid No.2
Pin No.6: Cathode
Pin No.7: Grid No.1

READING GUN -

Pin No.1: Heater
Pin No.2: Grid No.3
Pin No.3: Cathode
Pin No.4: Heater
Pin No.5: Grid No.2
Pin No.6: Cathode
Pin No.7: Grid No.1

GRAPHECHON

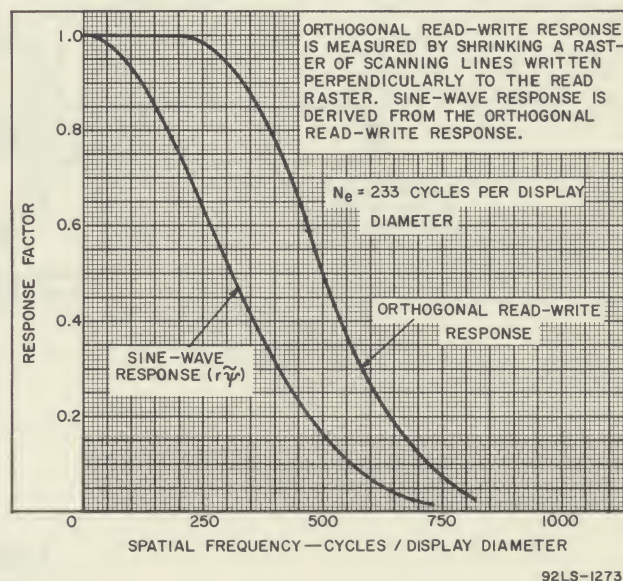
Scan-Conversion Storage Tube

RCA
DEVELOPMENTAL TYPE
C22008

RCA Developmental Type C22008 is a short, sturdy graphechon that is electrically similar to type C22006. It differs from the C22006 in that it is not supplied with integral shielding and it employs stiff-lead base pins. Like the C22006 it has low-power "dark heaters" and both its reading and writing guns are magnetic-deflection, electrostatic-focus types. The approximate deflection angle of each gun is 50°.

- Intended primarily for use in systems employing television monitors utilizing 500 to 1500 scanning lines
- Intended primarily for use in systems where adjustable storage (persistence) times of 0.5 to 20 seconds are required
- Pattern erasure may be effected in approximately 500 ms when changing from one type of display to another
- Output-Signal-Electrode capacitance of approximately 16 pF

TYPICAL FREQUENCY RESPONSE CURVES



Typical Operating Conditions:

Voltages are referred to ground unless otherwise specified

Writing-Gun Section:

Heater Voltage ^a (AC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-8000 volts
Grid-No.1 (Control Grid) Voltage ^b	
for Beam Cutoff	-120 to -70 volts
Grid-No.2 Voltage ^b	300 volts
Grid-No.3 (Beam Focus) Voltage ^{b,c}	600 to 1400 volts
Grid-No.4 (Anode) Voltage ^d	ground
Socket	Cinch No.133-98-11-015, or equivalent

Reading-Gun Section:

Heater Voltage ^e (AC)	6.3 volts
Heater Current at 6.3 volts	0.095 A
Cathode Voltage	-1200 volts
Grid-No.1 (Control Grid) Voltage ^f	
for Beam Cutoff	-120 to -70 volts
Grid-No.2 Voltage ^f	300 volts
Grid-No.4 (Beam Focus) Voltage ^{c,f}	0 to 200 volts
Grids-No.3 & No.5 (Anode) Voltage ^g	-20 to 0 volts
External Conductive Coating	ground
Socket	Cinch No.133-98-11-015, or equivalent

Target Section:

Output-Signal-Electrode Voltage	0 volts
Shading Electrode Voltage ^g	0 to 20 volts
Backplate Voltage ^g	-15 to 0 volts

^a One side to be externally connected to writing-gun cathode.

^b With respect to writing-gun cathode.

^c Adjust for best focus.

^d Connected internally to external conductive coating.

^e One side to be externally connected to reading-gun cathode.

^f With respect to reading-gun cathode.

^g Adjust for optimum signal and storage performance.

For further information or application assistance on this device, contact your RCA Field Representative or write Storage-Tube Marketing, RCA, Lancaster, Pa.

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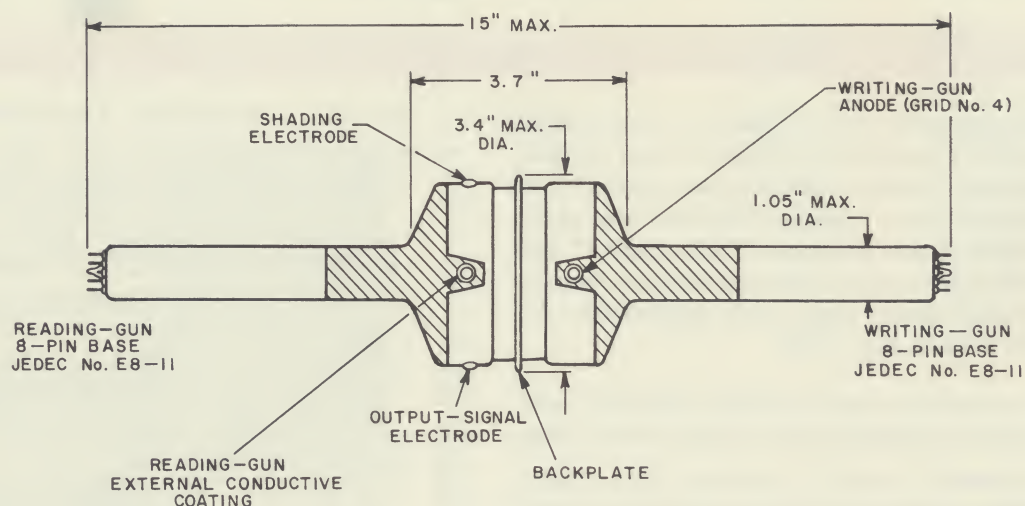


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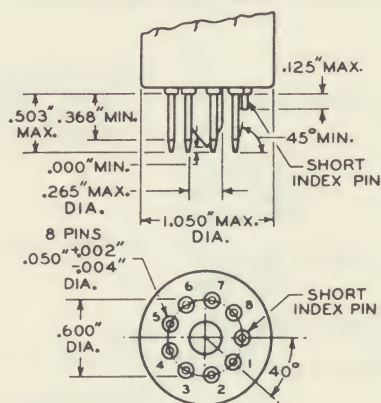
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DIMENSIONAL OUTLINE



92LS-1284

BASE DRAWING Both Guns



BASE CONNECTIONS

WRITING GUN -

- Pin No.1: Heater
- Pin No.2: Grid No.1
- Pin No.3: IC - Do not use
- Pin No.4: Grid No.3
- Pin No.5: Grid No.2
- Pin No.6: IC - Do not use
- Pin No.7: Cathode
- Pin No.8: Heater

READING GUN -

- Pin No.1: Heater
- Pin No.2: Grid No.1
- Pin No.3: Grid No.4
- Pin No.4: Grids No.3 & No.5
- Pin No.5: Grid No.2
- Pin No.6: IC - Do not use
- Pin No.7: Cathode
- Pin No.8: Heater

GRAPHECHON

Scan-Conversion Storage Tube

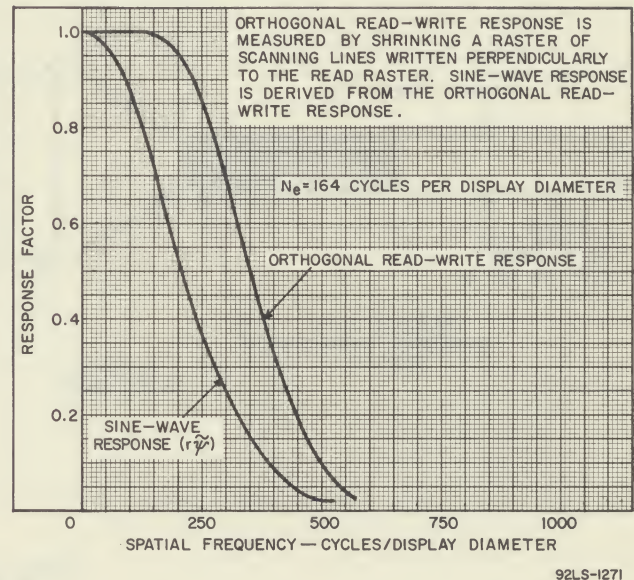
RCA
7539

SUPPLEMENTARY DATA

RCA-7539 has provided reliable service in scan-conversion applications for many years. It has been used extensively in air-traffic-control applications but is being replaced in new systems by the smaller types such as the C22007. The 7539 employs a magnetic-deflection, electrostatic-focus type writing gun and a magnetic-deflection, magnetic-focus type reading gun. The approximate deflection angle of each gun is 30°.

- Resolution of 150 range rings per display radius with a response of 50 per cent or better
- Intended primarily for use in systems where adjustable storage (persistence) times of 0.5 to 20 seconds are required
- Pattern erasure may be effected in approximately 2 seconds when changing from one type of display to another
- Output-Signal-Electrode Capacitance of approximately 16 pF

TYPICAL FREQUENCY RESPONSE CURVES



Typical Operating Conditions:

Voltages are referred to ground unless otherwise specified

Writing-Gun Section:

Heater Voltage ^a (AC)	6.3 volts
Heater Current at 6.3 volts	0.6 A
Cathode Voltage	-10,000 volts
Grid-No.1 (Control Grid) Voltage ^b	
for Beam Cutoff	-40 to -100 volts
Grid-No.2 Voltage ^b	200 volts
Grid-No.3 (Beam Focus) Voltage ^{b,c}	1000 to 3000 volts
Grid-No.4 (Anode) Voltage ^d	ground
Socket	Alden No.212FTSC, or equivalent

Reading-Gun Section:

Heater Voltage ^e (AC)	6.3 volts
Heater Current at 6.3 volts	0.6 A
Cathode Voltage	-2000 volts
Grid-No.1 (Control Grid) Voltage ^f	
for Beam Cutoff	-40 to -100 volts
Grid-No.2 (Anode) Voltage ^g	-30 to 0 volts
External Conductive Coating	ground
Socket	Alden No.212FTSC, or equivalent

Target Section:

Output-Signal-Electrode Voltage	0 volts
Shading Electrode Voltage	10 volts
Backplate Voltage ^g	-4 to -8 volts

^aOne side to be externally connected to writing-gun cathode.

^bWith respect to writing-gun cathode.

^cAdjust for best focus.

^dConnected internally to external conductive coating.

^eOne side to be externally connected to reading-gun cathode.

^fWith respect to reading-gun cathode.

^gAdjust for optimum signal and storage performance.

For further information or application assistance on this device, contact your RCA Field Representative or write Storage-Tube Marketing, RCA, Lancaster, Pa.

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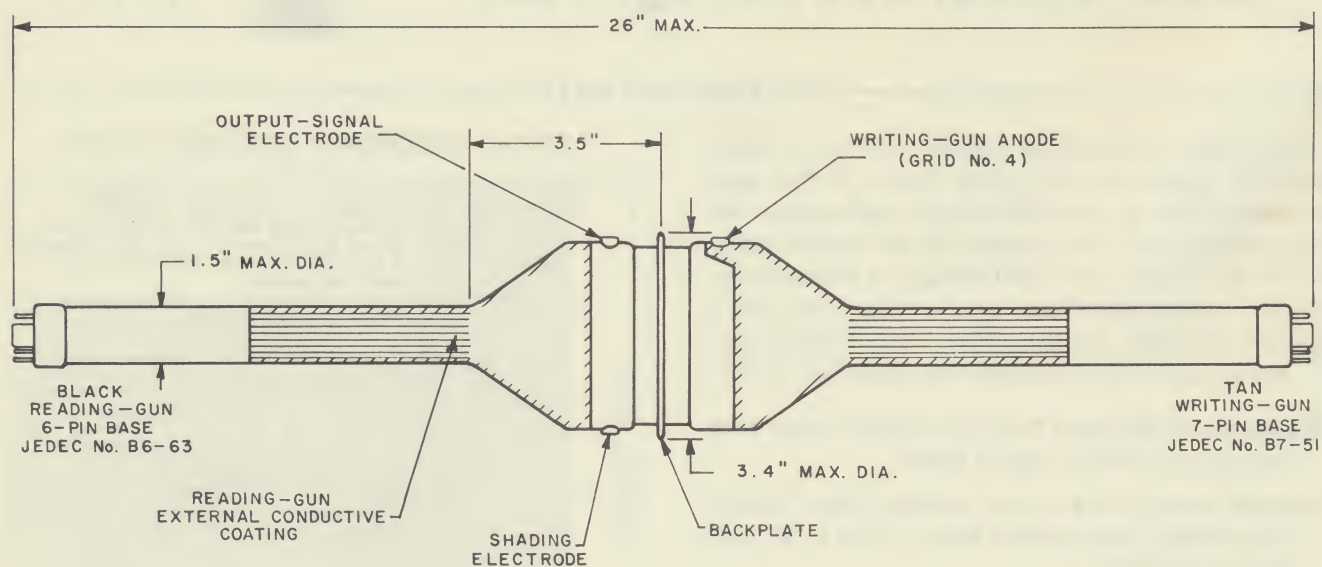
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ELECTRONIC COMPONENTS AND DEVICES

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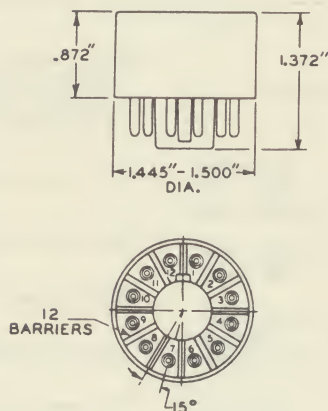
DIMENSIONAL OUTLINE



92LS-1285

BASE DRAWING

Both Guns



BASE CONNECTIONS

WRITING GUN -

Pin No. 1: Heater
Pin No. 2: Grid No.1
Pin No. 6: Grid No.3
Pin No. 7: No Connection
Pin No.10: Grid No.2
Pin No.11: Cathode
Pin No.12: Heater

READING GUN -

Pin No. 1: Heater
Pin No. 2: Grid No.1
Pin No. 6: Grid No.2
Pin No.10: No Connection
Pin No.11: Cathode
Pin No.12: Heater